March 8, 1855.

Sir BENJAMIN BRODIE, Bart., V.P., in the Chair.

The following papers were read :—

I. "On the Perihelia and Nodes of the Planets." By Edward J. Cooper, F.R.S. Received February 2, 1855.

Prefatory to my volume on Cometic Orbits, published in 1852, I invited the attention of astronomers to the several points of resemblance between the planetary orbits and those of periodic comets. Among these it was shown, that of the heliocentric longitudes of perihelia and ascending nodes of the then known planets and periodic comets, two-thirds were situated in the heliocentric semicircle between 315° and 135°. The planets stood thus in quadrants—

L. P.'s between	45° and 135° =		9	16.
	135 and 225 = 4	7		
	225 and 315 = 3			
	315 and 45 =		7	
☊ between	45 and 135 =		13	14.
	135 and 225 = 4	8		
	225 and 315 = 4			
	315 and 45 =		1	

Here the L. P.'s appeared as 16 to 7, and the ascending nodes as 14 to 8. Two additional asteroids were subsequently discovered leaving the L. P.'s as 16 to 9, and the ascending nodes as 15 to 9.

Again, in 1853, I sent a note upon the same subject to the Royal Astronomical Society of London. At that time a considerable addition had been made to the asteroids, and the total number of planets had risen from 25 to 35. Following the same distribution of the

perihelia and ascending nodes as in my previously published work, the result was—

$$\left.\begin{array}{lll} \text{L. P.'s between} & 45^{\circ} \text{ and } 135^{\circ} = & 13 \\ & \left.\begin{array}{l} 135 \text{ and } 225 = 5 \\ 225 \text{ and } 315 = 6 \end{array}\right\} & 11 \\ & 315 \text{ and } \ 45 = & 11 \end{array}\right\} 24.$$

$$\left.\begin{array}{lll} \text{☊} \quad \text{between} & 45 \text{ and } 135 = & 19 \\ & \left.\begin{array}{l} 135 \text{ and } 225 = 9 \\ 225 \text{ and } 315 = 4 \end{array}\right\} & 13 \\ & 315 \text{ and } \ 45 = & 2 \end{array}\right\} 21.$$

The suspicion of some yet undiscovered law became strengthened by this further investigation; and it occurred to me to ascertain if any other heliocentric semicircles would mark the effect of such law more clearly. Let me be permitted to extract the concluding passage from the note as it is printed in the Royal Astronomical Society's Notices:—

"But if, instead of the semicircles 315° to 135° and 135° to 315°, we adopt those from 45° to 225° and 225° to 45°, we see that of the ascending nodes of thirty-four planets, twenty-eight are found in the first semicircle and only six in the second. Again, the semicircles that contain the greatest number of L. P.'s of planets are between 0° and 180°, or 10° and 190°. That which contains the greatest number of nodes is between 35° and 215°. In the first case there are twenty-six, and in the latter twenty-nine. The quadrant containing the largest number of L. P.'s of planets is that between 11° and 101°, of which there are sixteen. That containing the largest of nodes is from 35½° to 125½°, of which there are twenty."

At the present moment (January 1855) we have orbits, more or less accurate, of forty-one planets. It cannot be altogether uninteresting to pursue once more the traces of a law still unknown, if it have existence. Our position now stands thus—

$$\left.\begin{array}{lll} \text{L. P.'s between} & 45^{\circ} \text{ and } 135 = & 16 \\ & \left.\begin{array}{l} 135 \text{ and } 225 = \ 6 \\ 225 \text{ and } 315 = \ 6 \end{array}\right\} & 12 \\ & 315 \text{ and } \ 45 = & 13 \end{array}\right\} 29.$$

$$\text{☊ between } \left.\begin{array}{l} 45 \text{ and } 135 = \qquad 19 \\ \left.\begin{array}{l}135 \text{ and } 225=11\\ 225 \text{ and } 315 = \;\,5\end{array}\right\} 16 \\ 315 \text{ and } \;\;45 \qquad\quad 5\end{array}\right\} 24.$$

But, be it remembered, that in 1853 of the then known planets the greatest number of L. P.'s were found to be situated in the heliocentric semicircles 0° to 180° or 10° to 190°. At present we shall find the perihelia of thirty out of the forty-one planets in either of these semicircles. The greatest number of nodes were then (1853) between 35° and 315°=29; and 45° and 225°=28. At present, of forty planets there are thirty nodes in either of these heliocentric semicircles. These facts are at least very singular. I may tabulate them—

Of forty-one planets, L. P.'s between 0° and 180°=30
10 and 190=30
Of forty planets ☊ between 35 and 215=30
45 and 225=30
and between 354° to 355° and 174 to 175=31

We here perceive that there are thirty L. P.'s situated in the heliocentric semicircle between 0° to 10° and 180° to 190°. It is also the fact, that there are thirty ascending nodes between 357° to 7° and 177° to 187°, which may be called the same semicircle as that in which the thirty L. P.'s are found.

The quadrant containing the greatest number of L. P.'s of the forty-one planets, is that between 10° and 100°=20.

Those containing the greatest number of ascending nodes, are

between 36° to 43° and 126° to 133°=20
and between 62 to 66 and 152 to 156=20.

Surely there must be an undiscovered cause determining the orbits in this way. Having laid these facts before my first assistant Mr. Graham, he computed the degree of probability of such a law, arguing thus:—" Were the nodes and perihelia indifferent to all heliocentric longitudes, it would of course be an equal chance in the case of a planet whose orbit had not been determined, in which semicircle either would be found; and the *à priori* probability that,

of the forty-one known L. P.'s, thirty would be in one semicircle, is about $\frac{1}{696}$; and that of the forty ascending nodes, thirty-one would be in one semicircle, is about $\frac{1}{4021}$. Thus the probability that there is some influence causing a tendency to one semicircle, ascertained from the facts before us, is very strong: for, for the L. P.'s, the odds are about 660 to 1, and for the ascending nodes about 4430 to 1 in favour of such a supposition." But after all it may be an accidental coincidence; as, consistently with the laws of planetary motion, such a congregation of perihelia or nodes may occur at periods exceedingly remote. The further consideration of this subject must be left to analysts, of leisure and inclination to pursue it.

II. "On Circumstances modifying the Action of Chemical Affinity." By J. H. Gladstone, Ph.D., F.R.S. Received February 1, 1855.

The question intended to be solved in this communication is,—what takes place when two binary compounds AB and CD are brought together under such circumstances that both they themselves and the products of their mutual action remain free to react? Do they, according to a generally received opinion, remain unaltered, or, should the affinities so preponderate, become simply AB and CB? Or do A and C, according to Berthollet's view, divide themselves in certain proportions between B and D, the said proportions being determined not solely by the difference of energy in the affinities, but also by the difference of the quantities of the bodies? And, supposing the latter to be the correct view, do the amounts of AD and CB produced by the reaction, increase progressively with the relative increase of AB, or do sudden transitions occur, such as Bunsen and Debus have recently observed in certain cases where the products were removed at once from the field of action?

A reply was sought in the colours produced upon mixing different salts in aqueous solution. There were not many coloured salts suitable for the purpose, as it generally happens that a base gives the same colour with whatever acid it is combined, and *vice versâ*; but the compounds of sesquioxide of iron were peculiarly adapted to